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PATENT

Agent's Docket
No. 462-USA

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	ROUGEOT et al.
Serial No.:	09/334,671
Filed:	June 17, 1999
For:	INDIRECT X-RAY IMAGE DETECTOR FOR RADIOLOGY
Examiner:	Shun Lee
Group Art Unit:	2878

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450
USA

TRANSMITTAL OF APPELLANT'S BRIED (37 CFR 1.192)

Transmitted herewith, in triplicate, is the Appellant's Brief in this application, with respect to the Notice of Appeal filed on February 4, 2004.

A cheque in the amount of $330.00 covering the fee for filing the brief in support of the appeal is also enclosed.

If any additional fee is required to effect the filing of this brief, the Commissioner is hereby authorized to charge it to Deposit Account No. 162472.

Respectfully submittted,

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BRIEF OF APPELLANT (37 CFR 1.192)

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BRIEF OF APPELLANT (37 CFR 1.192)

Sir:

This is an appeal from the final rejection dated September 5, 2003, rejecting claims 1-12 and 14-21.

I. REAL PARTY IN INTEREST (37 CFR 1.192 (c) (1))

The real party in interest in this action is FTNI INC. by virtue of the Assignment dated May 21, 1999 and recorded in the U.S. Patent and Trademark Office under REEL/FRAME: 010054/0556.

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II. RELATED APPEALS AND INTERFERENCES (37 CFR 1.192 (c) (2))

There are no related appeals of interferences.

III. STATUS OF CLAIMS (37 CFR 1.192 (c) (3))

The status of the claims is:

Claims pending: 1-12 and 14-21

Claims withdrawn from consideration: 13

Claims allowed: none

Claims objected to: none

Claims rejected: 1-12 and 14-21

Claims on appeal: 1-12 and 14-21

IV. STATUS OF AMENDMENTS (37 CFR 1.192 (c) (4))

No amendments have been filed after final rejection. However, a Declaration under 37 CFR 1.132 was filed on January 28, 2004 which specifically addressed the remaining ground of the Examiner's rejection.

V. SUMMARY OF THE INVENTION (37 CFR 1.192 (c) (5))

Appellant's invention is directed generally to an indirect x-ray image detector for radiology. The term "indirect" means that the x-rays are not directly converted into electrical charges, but rather they are first converted into light using a scintillator and then light is converted into electrical charges. The x-ray image detector of the Appellant's invention comprises an active matrix substrate with scanning and read-out circuits, wherein over this active matrix substrate there is deposited a photoreceptor made of a co-planar thin layer of

amorphous selenium based multilayer structure, and this photoreceptor is covered with a light transparent biasing electrode on top of which there is provided an x-ray conversion scintillator. See the specification at page 1 lines 4-11 and claim 1. See also the specification at page 4, lines 11-18.

In Appellant's invention, the role of the selenium multilayer photoreceptor is two-fold. Firstly, it acts as the light absorber layer, thereby converting the incident energy into electrical charges proportional to the intensity level of the incident radiation. And secondly, it acts as the charge transport layer whereby the generated carriers are transported under the effect of an applied electric field to the underlying pixelated electrode. The thin selenium multilayer has a thickness which is much less than the width of a pixel electrode, so that in association with the direction of the electric field and high intrinsic resistance of selenium, the lateral spread of charge is minimized. See page 6, lines 21-24 to page 7, lines 1-4.

Claims 2-12 and 14-21 depend directly or indirectly from claim 1.

Claim 2 describes the x-ray image detector in which the active matrix substrate is a two dimensional array of thin film transistors (TFT) associated with a storage capacitance and having conduction pads with electric connection to the photoreceptor. See Figs. 2 and 3. Support for claim 2 is found in the specification at page 4, lines 22-24 and page 5, lines 1-2 and page 8, lines 17-19.

Claim 3 further specified that the storage capacitance mentioned in claim 2 is part of the TFT architecture. Support for this claim 3 is found in the specification at page 4, line 24 and page 5, line 1.

Claim 4 further specifies that the storage capacitance mentioned in claim 2 is an integral part of the photoreceptor. Support for this claim 4 is found in the specification at page 6, line 14.

Claim 5 further specifies that the TFT mentioned in claim 2 are made of amorphous silicon. Support for this claim 5 is found in the specification at page 4, lines 23-24.

Claim 6 describes the x-ray image detector in which the amorphous selenium based multilayer structure is of n-i-p or p-i-n type, wherein the n-layer is a hole blocking layer, the p-layer is an electron blocking layer and the i-layer, sandwiched between the n and p layers, is an

amorphous selenium layer doped with chlorine and arsenic. Support for this claim 6 is found in the specification at page 5, lines 2-24.

Claim 7 further specifies that the i-layer of amorphous selenium mentioned in claim 6 is doped with 1-100 ppm of chlorine and 0.1-5% by wt. of arsenic. Support for this claim 7 is found in the specification at page 5, lines 9-10.

Claim 8 further specifies that the n-layer mentioned in claim 6 is a thin selenium layer doped with an alkaline metal or an oxide or halogenide of such metal. Support for this claim 8 is found in the specification at page 5, lines 3-5.

Claim 9 further specifies that the alkaline metal mentioned in claim 8 is selected from lithium, sodium, potassium and cesium. Support for this claim 9 is found in the specification at page 5, line 4.

Claim 10 further specifies that the p-layer mentioned in claim 6 is a thin layer of arsenic enriched amorphous selenium. Support for this claim 10 is found in the specification at page 5, lines 6-7.

Claim 11 further specifies that the arsenic enrichment in the p-layer mentioned in claim 10 is 1-38% by wt. Support for this claim 11 is found in the specification at page 5, line 11.

Claim 12 further specifies that each of the n and p layers mentioned in claim 6 is less than 1µm in thickness. Support for this claim 12 is found in the specification at page 5, lines 3 and 6.

Claim 14 indicates that the thickness of the multilayer structure of the photoreceptor mentioned in claim 1 is 5 to 20µm. Support for this claim 14 is found in the specification at page 8, line 15.

Claim 15 specifies that the light transparent biasing electrode is a co-planar indium tin oxide (ITO) layer positioned on top of the amorphous selenium based multilayer structure. Support for this claim 15 is found in the specification at page 5, lines 7-8.

Claim 16 specifies that the amorphous selenium based structure is of the p-i-n type and the light transparent biasing electrode is set to a negative potential to provide the TFT with high voltage protection. Support for this claim 16 is found in the specification at page 6, lines 1-5.

Claim 17 specifies that the amorphous selenium based multilayer structure is of the n-i-p type, and a high voltage protection device is also provided shunting the storage capacitance. Support for this claim 17 is found in the specification at page 6, lines 6-11.

Claim 18 specifies that the biasing electrode, mentioned in claim 1, also serves to match indices of refraction of the scintillator and the amorphous selenium based multilayer structure. Support for this claim 18 is found in the specification at page 4, lines 17-18.

Claim 19 specifies that the amorphous selenium based multilayer structure is optimized for electrical transport where dark current is below 200 pA/cm^2 and residual image is less than 5%. Support for this claim 19 is found in the specification at page 7, lines 5-7.

Claim 20 specifies that the scintillator is made of a material selected from cesium iodide doped with sodium or from a material selected from barium fluoride, calcium tungstate and sodium iodide, emitting in the blue spectrum. Support for this claim 20 is found in the specification at page 6, lines 15-20.

Claim 21 specifies that the photoreceptor, the biasing electrode and the scintillator referred to in claim 1, are enclosed in a housing providing environmental, electric and mechanical protection. Support for this claim 21 is found in the specification at page 9 lines 1-4.

VI. ISSUES (37 CFR 1.192 (c) (6))

The following issues will be addressed in the Argument:

A. Whether the combination of Morton (U.S. Patent No. 5,693,947) in view of Perez-Mendez (U.S. Patent No. 5,596,198) and Schiebel et al. (U.S. Patent No. 5,396,072), cited by the Examiner, renders the invention defined in independent claim 1 and dependent claim 2-5, 14 and 20 obvious under 35 U.S.C. § 103(a).

B. Whether the combination of Morton in view of Perez-Mendez and Schiebel et al. and further in view of Polischuk et al. (U.S. Patent No. 5,880,472), cited by the Examiner, renders the invention defined by dependent claims 6-11, 15-17 and 17 obvious under 35 U.S.C. § 103(a).

C. Whether the combination of Morton in view of Perez-Mendez, Schiebel et al. and

Polischuk et al. and further in view of Brauers et al. (U.S. Patent No. 6,128,362), cited by the Examiner, renders the invention defined in dependent claim 12 obvious under 35 U.S.C. § 103(a).

D. Whether the combination of Morton in view of Perez-Mendez and Schiebel et al. and further in view of Kwasnick et al. (U.S. Patent No. 5,132,593), cited by the Examiner, renders the invention defined in claims 18 and 21 obvious under 35 U.S.C. § 103(a).

VII. GROUPING OF THE CLAIMS (37 CFR 1.192 (c) (7))

Claims 1-5 and 14 have been rejected using the ground of rejection set out in (A) above and they will stand or fall together as one group.

Claim 20 has also been rejected using the ground of rejection set out in (A) above, but it is believed to recite additional novel subject matter over and above that recited in independent claim 1. Therefore, claim 20 should receive separate consideration.

Claims 6-11, 15-17 and 19 have been rejected using the ground of rejection set out in (B) above and they will stand or fall together as one group.

Claim 12 has been rejected using the ground of rejection set out in (C) above.

Claims 18 and 21 have been rejected using the ground of rejection set out in (D) above and will stand or fall together as one group.

VIII. ARGUMENT (37 CFR 1.192 (c) (8))

A. The Rejection of claims 1-5, 14 and 20 under 35 U.S.C. § 103

In the final Office Action mailed September 5, 2003, claims 1-5, 14 and 20 were rejected under 35 U.S.C. § 103 as being obvious over Morton (U.S. Patent No. 5,693,947) in view of Perez-Mendez (U.S. Patent No. 5,596,198) and Schiebel et al. (U.S. Patent No. 5,396,072). Appellant respectfully disagrees with this rejection and submits that it should be reversed for the cogent reasons hereinafter set forth.

As stated in the SUMMARY OF THE INVENTION above, and as claimed in the rejected independent claim 1 and dependent claims 2-5, 14 and 20, Appellant's invention relates to an indirect x-ray image detector for radiology, which means that the x-rays are not directly converted into electrical charges (as this is done in a direct x-ray image detector), but rather they are first converted into light and then light is converted into electrical charges. The direct and indirect x-ray image detectors are therefore two different types of detectors having distinct systems of operation. Morton discloses an indirect x-ray image detector using a radiation converter made of a thin semiconductor layer of amorphous silicon (a-Si:H) or polysilicon (p-Si) as indicated, for example, in column 5, lines 35-36; column 6, lines 60-61; column 7, lines 15-17; column 7, lines 24-28; column 7, lines 55-58; column 8, lines 46-47; and elsewhere. Morton does not describe nor suggest an indirect x-ray image detector suitable for radiology that uses a photoreceptor made of a co-planar thin layer of amorphous selenium-based multilayer structure that would absorb light, thereby converting the indirect incident energy into electrical charges as disclosed by the Appellant. This basic difference has been admitted by the Examiner.

Although Morton discloses a variety of different forms that the radiation converter may take (column 10, line 35 to column 11, line 18), all of these are semiconductors and similar materials that are useful for detecting α, β, γ and x-ray radiation. All these materials are intended to be used as radiation (x-ray, γ-ray, α-ray or β-ray) converters, and there is no indication whatsoever in Morton that they can be used as photoconductors suitable to absorb light.

As is well known in the art related to such radiation converters, they operate on the principle of a pixelated structure since the flow of the charges therein comes from pixelation. This is clearly the case of Morton as explained in the Declaration under 37 CFR 1.132 of Sorin Marcovici filed on January 28, 2004.

In response to the Examiner's contention that Morton's radiation converter is a photoreceptor which is also not pixelated, the following statement was made by Mr. Marcovici in his declaration:

"I have carefully read and understood U.S. Patent No. 5,693,947 of Morton, to which the Examiner refers, and I cannot agree with the Examiner's conclusion that Morton's photoreceptor 201 is not pixelated.

"By comparing Morton's Fig. 7 with Figs. 2 and 3 of Rougeot et al., I observe a clear difference in the way the charges are driven to collection electrodes. In the structure of Rougeot et al, the charges follow the high intensity electrical field lines and move parallel through the entire amorphous selenium thickness, arriving at continuous planar electrodes. Thus, the selenium based multilayer structure of Rougeot et al is not pixelated.

"On the other hand, as shown in Morton's Fig. 7, within the ionization medium 201, by extra depositions of doped materials around the pixel capacitor, there is a supplemental electrical field, Pm, totally different from the field across capacitor C2, that creates "means of electronic focussing" (column 8, line13) on the charges, guiding them along curved trajectories to specific pixel locations (see also Morton's Claim 23). Such ionization medium is called "pixelated" and consequently Morton's photoreceptor 201 is pixelated.

"Morton's structure basically consists of two capacitors in series, with C_1 of the pixel 100 to 10,000 times larger (column 4, line 5) than C_2 of the uni-layer ionization medium. Given the basic electrostatic equations, the larger the capacitance the thinner the dielectric material of the capacitor must be for the same area of the electrodes. Since the pixel capacitors have electrodes much smaller than the continuous ionization medium C_2 plate, it implies that, for not very different dielectric constants of materials, the thickness of C_2 dielectric (ionization medium) is much larger than the thickness of C_1 dielectric (pixel capacitor) and possibly the width of the pixel. This qualitative estimation is coherent with the intended use of the dual capacitors structure implemented to protect the pixel capacitor and read-out circuitry (see column 1, starting at line 46, of Morton). The operation of Morton structure is, therefore, based on a simple transfer of charges from C_2 to C_1.

"In contrast, the amorphous selenium of Rougeot et al. has a multi-layer structure, typically with three differently doped layers, n-i-p or p-i-n depending on the embodiment, in which the top and bottom layers operate as blocking contacts. This multi-layer structure operation, as described starting on page 6, line 21, of the disclosure, is more complex and different from that of a simple capacitor. Furthermore, on page 7, line 2, it is clearly stated that "the thickness of the selenium multilayer is much less than the width of a pixel electrode".

"The distinction between charge transfer mechanisms is emphasized by Morton's statement: "since positive ions typically have lower mobility than electrons in ionization media, spatial resolution will usually be maximized when positive ions caused to drift to electrode 13" (column 6, lines 54-57). In the structure of Rougeot et al., amorphous selenium does not produce ions, but rather electrons and holes (positive charge carriers) and the elections mobility is typically 20

times smaller than holes mobility. In other words, in the structure of Rougeot et al. positive charges move much faster than negative charges, whereas in Morton structure there is the opposite condition.

"For the above reasons, I do not agree with the Examiner's statement that the structure of Morton is essentially similar to that of Rougeot et al. and that Morton's photoreceptor is not pixelated."

It is therefore clear that Morton's radiation detector can in no way be compared to Appellant's indirect x-ray detector either by way of structure or by way of principle of operation.

The deficiencies of the Morton patent are not corrected by the addition of Perez-Mendez and Schiebel et al. There is nothing in Perez-Mendez that would even hint at the possibility of using a co-planar thin layer of any kind of a non-pixelated photoreceptor that would be capable to convert light into electrical charges, let alone the desirability of using specifically a co-planar thin layer of amorphous selenium based multilayer structure as defined in claim 1 of the Appellant's application. The Examiner has referred to the disclosure in the Perez-Mendez patent where, in column 6, lines 60-67, it is stated that a p-i-n structure can be formed of hydrogenated amorphous silicon (a-Si:H) and alternatively of materials such as amorphous selenium, antimony trisulphide, cadmium sulphide, antimoney sulphide oxysulphide and crystalline materials such as Si, Ge, gallium arsenide and their alloys. This is provided in conjunction with a photosensor array 32 (c.f. column 6, line 57) which is a pixidated photosensor array as mentioned in column 8, lines 12-15, and illustrated in Fig. 5 of the Perez-Mendez patent and used for the gamma ray camera shown in Fig. 1. Thus, the special resolution in Perez-Mendez comes from a pixilated array of pixel diodes 67-70 with separations 71, 72 therebetween for circuit interconnections (c.f. column 7, lines 60-61 and Fig. 4). In fact, a solid state gamma ray camera is necessarily pixelated to reduce to a minimum the read-out capacitance of a multiplicity of local detectors. This is completely different and disconnected from the invention of the Appellant where the photoreceptor is made of a co-planar thin layer of amorphous selenium based structure which, as explained at the very beginning of the application (c.f. page 1, lines 7-11) is intended to replace the usual array of pixelated photodiodes such as used by Perez-Mendez.

With regard to Schiebel et al., this reference is irrelevant to the indirect x-ray image detector of Appellant's invention since it concerns only direct conversion of x-rays into a thick photoconductor layer. In Schiebel et al., there is no scintillator to convert x-rays into light, but rather there is a direct conversion detector in which conventional readout panels are associated to x-ray thick photoconductors, among which amorphous selenium is included (c.f. column 5, lines 38-42).

Contrary to Schiebel et al., the Appellant clearly claims "an indirect x-ray image detector" as it is defined right at the beginning of the disclosure, on page 1, lines 5-7. Such indirect detector has an x-ray conversion scintillator that absorbs about 80%-90% of incoming radiation while converting x-rays into light (c.f. page 8, lines 11-12 of the specification). Moreover, Appellant's photoreceptor is made of "a co-planar thin layer of amorphous selenium based multilayer structure" which is totally different from the thick photoconductor 32 of Schiebel et al. which "must have a thickness of between 200 and 800 μm so as to achieve adequate absorption of the x-ray quanta" (c.f. column 5, lines 40-42).

As the three patents applied by the Examiner do not teach what is set out in Appellant's claims and do not provide the basis for developing the invention to a person having ordinary skill in the art to which the subject matter pertains, the Examiner's reliance on these references is not properly grounded and the rejection based thereon should be withdrawn. The prior art "references alone or in combination, do not make obvious the....invention. There is no teaching or suggestion whereby a person of ordinary skill would have been led to select these mechanical and electrical structures and concepts and combine them as did [the inventor] in the [patented] invention." Sensonics Inc. v. Aerosonic Corp., 81 F.3d 1566, 1570, 38 USPQ 2d 1551, 1554 (Fed. Cir. 1996).

Also, "it is impermissible to use the claimed invention as an instruction manual or "template" to piece together isolated disclosures and teachings of the prior art so that the examiner might deem the proposed modification to be "within the level of ordinary skill in the art." The mere fact that the references may be modified in the manner suggest by the examiner does not make such modification obvious unless the prior art suggested the desirability of the

modifications." In re Fritch, 972 F.2d 1260, 1266 n.15, 23 USPQ2d 1780, 1783-84 n 15 (Fed. Cir. 1992).

A more recent decision In re Sang-Su Lee ("In re Lee"), 277 F.3d 1338, 61 USPQ 2d 1430 (Fed. Cir. 2002), provides a good review of the authorities requiring a showing of teaching, suggestion or motivation to select and combine prior art references. These are summarized as follows:

"As applied to the determination of patentability vel non when the issue is obviousness, "it is fundamental that rejections under 35 U.S.C. § 103 must be based on evidence comprehended by the language of that section." In re Grasselli, 713 F.2d 731, 739, 218 USPQ 769, 775 (Fed. Cir. 1983). The essential factual evidence on the issue of obviousness is set for in Graham v. John Deere Co., 383 U.S. 1, 17-18, 148 USPQ 459, 467 (1966) and extensive ensuing precedent. The patent examination process centers on prior art and the analysis thereof. When patentability turns on the question of obviousness, the search for and analysis of the prior art includes evidence relevant to the finding of whether there is a teaching, motivation, or suggestion to select and combine the references relied on as evidence of obviousness. See, e.g., McGinley v. Franklin Sports, Inc., 262 F.3d 1339, 1351-52, 60 USPQ2d 1001, 1008 (Fed. Cir. 2001) ("the central question is whether there is reason to combine [the] references," a question of fact drawing on the Graham factors).

"The factual inquiry whether to combine references must be thorough and searching." Id. It must be based on objective evidence of record. This precedent has been reinforced in myriad decisions, and cannot be dispensed with. See, e.g., Brown & Williamson Tobacco Corp v. Philip Morris Inc., 229 F.3d 1120, 1124-25, 56 USPQ2d 1456, 1459 (Fed. Cir. 2000) ("a showing of a suggestion, teaching, or motivation to combine the prior art references is an 'essential component of an obviousness holding'") (quoting C.R. Bard, Inc., v. M3 Systems, Inc., 157 F.3d 1340, 1352, 48 USPQ2d 1225, 1232 (Fed. Cir. 1998)); In re Dembiczak, 175 F.3d 994, 999, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999) ("Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art

references."); In re Dance, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed. Cir. 1998) (there must be some motivation, suggestion, or teaching of the desirability of making the specific combination that was made by the applicant); In re Fine, 837 F.2d 1071, 1075, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988) ("'teachings of references can be combined only if there is some suggestion or incentive to do so.'") (emphasis in original) (quoting ACS Hosp. Sys., Inc. v. Montefiore Hosp., 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984)).

"The need for specificity pervades this authority. See, e.g., In re Kotzab, 217 F.3d 1365, 1371, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000) ("particular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed"); In re Rouffet, 149 F.3d 1350, 1359, 47 USPQ2d 1453, 1459 (Fed. Cir. 1998) ("even when the level of skill in the art is high, the Board must identify specifically the principle, known to one of ordinary skill, that suggests the claimed combination. In other words, the Board must explain the reasons one of ordinary skill in the art would have been motivated to select the references and to combine them to render the claimed invention obvious.")."

It is respectfully submitted that in the present case the Examiner has failed to satisfy the above mentioned principles.

Thus, in summary, Morton deals with a type of radiation detectors where the converter is a semiconductor and acts as the dielectric of the capacitor as well as its photodetector and requires pixelation to be operational. In Appellant's indirect image detector, the co-planar thin layer of amorphous selenium based multilayer structure acts as a photoconductor (rather than a semiconductor) and is not associated with the operation of the capacitors; an electric field applied from the outside drives and directs the charges in the thin amorphous selenium layer of the Appellant's invention, without any need of pixelation. Morton gives no hint that in its converter the semiconductor can be replaced by a photoconductor made of a co-planar thin layer of amorphous selenium based multilayer structure as set out in Appellant's invention.

Perez-Mendez deals with a gamma ray camera rather than an indirect x-ray image detector. It does mention a photosensor array that comprises a p-i-n structure of its photodiode

where the lower layer "n" is formed of amorphous silicon (a-Si:H), and it is stated that it could also be formed of amorphous selenium, antimony trisulphide, cadmium sulphide, antimony sulphide oxysulphide, and crystalline materials such as Si, Ge, gallium arsenide and their alloys (cf. column 6, lines 57-67). Whatever the selected material, it is still a photodiode structure which requires pixelation (cf. column 8, line 13) and there is no indication whatsoever in Perez-Mendez that it could act as a photoconductor without pixelation. There is absolutely no suggestion in Perez-Mendez that out of the various materials enumerated, one would need to provide a thin layer amorphous selenium based multilayer structure to form a phtoconductor in an x-ray detector for radiology.

Schiebel et al. discloses a direct x-ray image detector which uses as photoreceptor a thick layer (200-800μm) of amorphous selenium based multilayer structure (cf. column 5, lines 38-40) to directly read the x-ray image without first converting it into light with a scintillator. There is no teaching or suggestion in Schiebel et al. that one could modify the thick layer amorphous selenium based photoconductor used for direct x-ray detectors, into a thin layer amorphous selenium based photoconductor for use in indirect x-ray detectors. There is absolutely no hint of this anywhere in Schiebel et al. or in Morton or in Perez-Mendez.

While thus far the appellant's arguments have been primarily directed to claim 1 and claims 2-5 and 14 which have been rejected by the Examiner on the combination of Morton, Perez-Mendez, and Schiebel et al., it should further be noted with regard to claim 20 that Morton uses an amorphous silicon photoreceptor which is structured by litography into pixels covered with thallium-doped cesium iodide yellow emitting scintillator or with a scintillator of another kind to which amorphous silicon is sensitive and which excludes scintillators emitting in blue sptectrum. Claim 20 is, therefore, distinct from Morton from that standpoint as well.

B. The Rejection of Claims 6-11, 15-17 and 19 Under 35 U.S.C. § 103

Regarding claims 6-11, 15-17 and 19, they were rejected over a combination of Morton, Perez-Mendez, Schiebel et al. and further in view of Polischuk et al. (U.S. Patent No. 5,880,472).

The combination of Morton, Perez-Mendez and Schiebel et al. has already been fully discussed above. The addition of Polischuk et al. certainly does not provide any further meaningful material. Polischuk's patent concerns direct conversion and describes and claims a multilayer plate with a thick photoconductive layer of doped amorphous selenium. It is not seen how Polischuk can be considered to provide any kind of suggestion or motivation to use a co-planar thin layer of amorphous selenium based multilayer structure in an indirect x-ray image detector.

C. The Rejection of claim 12 Under 35 U.S.C. § 103

Claim 12 has been rejected on the basis of the combination of Morton, Perez-Mendez, Schiebel et al., Polischuk et al. and further in view of Brauers et al. (U.S. Patent No. 6,128,362). The combination of the first four references has already been discussed above. Brauers et al. again deals with a direct x-ray image detector using a thick photoconductor layer of between 100 and 1000 μm (cf. column 4, lines 54-55). There is absolutely no teaching, suggestion, or motivation expressed in Brauers et al. to use a thin n-i-p or p-i-n amorphous selenium based multilayer structure in an indirect x-ray image detector, wherein the n and p layers would be less than 1μm in thickness.

D. The Rejection of claims 18 and 21 Under 35 U.S.C. § 103

Finally, claims 18 and 21 have been rejected on the basis of the combination of Morton, Perez-Mendez, Schiebel et al. and Kwasnick et al. (U.S. Patent No. 5,132,539). The combination of the first three patents has already been discussed above. Appellant's submit that further addition of Kwasnick et al. does not make claims 19 and 21 obvious. Kwasnick et al. does not deal with an x-ray image detector where the photoreceptor is made of amorphous selenium based multilayer structure. Furthermore, it provides for a separate layer of a material, such as an optical index matching substance for matching of the indices of refraction of the scintillator and the photoreceptor (cf. column 3, lines 21-24). It does not teach or suggest that the photoreceptor structure itself can be optimized for electrical transport. Also, Kwasnick et al. provides a

protective covering only for the scintillator (cf. column 1, line 67 to column 2, line 15) and not for the entire combination of the photoreceptor, the biasing electrode and the scintillator as set out in Appellant's claim 21.

IX. CONCLUSION

In sum, the Examiner has not demonstrated that it is known or suggested by the combined prior art to achieve Appellant's invention which basically resides in an unexpected finding that a photoconductor made of a co-planar thin layer of amorphous selenium based multilayer structure can act as a photoreceptor in combination with other elements to produce an indirect x-ray image detector for radiology. It is respectfully submitted that only through hindsight reconstruction and substantial modification of the references can the claimed features of Appellant's novel cable be derived. "To draw on hindsight knowledge of the patented invention, when the prior art does not contain or suggest that knowledge, is to use the invention as a template for its own reconstruction - an illogical and inappropriate process by which to determine patentability." Sensonics Inc. v. Aerosonic Corp., 81 F.3e 1566, 1570, 38 USPQ2d 1551, 1554 (Fed. Cir. 1996), citing W.L. Gore & Assoc. v. Garlock Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983).

Thus, it is submitted that the present invention as claimed is readily distinguishable from the applied prior art patents for reasons indicated. The invention provides considerable benefit and advantages, such as minimization of the lateral spread of charge and allowing the detector to operate under very high dose rates without having to saturate the output amplifiers. If the invention was obvious, it would have been adopted before in view of its advantages.

In view of the above, it is respectfully submitted that the Examiner's rejections are in error and should be reversed.

Respectfully submitted,

by:

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XI. APPENDIX OF CLAIMS (37 CFR 1.192 (c) (9))

The following sets forth all claims on appeal:

1. An indirect x-ray image detector suitable for radiology, comprising an active matrix substrate with scanning and read-out circuits, wherein over said active matrix substrate there is deposited a photoreceptor made of a co-planar thin layer of amorphous selenium based multilayer structure, said photoreceptor being covered with a light-transparent biasing electrode on top of which there is provided an x-ray conversion scintillator.

2. An x-ray image detector according to claim 1, in which the active matrix substrate is a two dimensional array of thin film transistors (TFT) associated with a storage capacitance and having conduction pads with electric connection to the photoreceptor.

3. An x-ray image detector according to claim 2, in which the storage capacitance is a part of the TFT architecture.

4. An x-ray image detector according to claim 2, in which the storage capacitance is an integral part of the photoreceptor.

5. An x-ray image detector according to claim 2, in which the TFT are made of amorphous silicon.

6. An x-ray image detector according to claim 1, in which the amorphous selenium based multilayer structure is of n-i-p or p-i-n type, wherein the n-layer is a hole blocking layer, the p-layer is an electron blocking layer and the i-layer sandwiched between the n and p layers is an amorphous selenium layer doped with chlorine and arsenic.

7. An x-ray image detector according to claim 6, wherein the i-layer of amorphous selenium is doped with 1-100 ppm of chlorine and 0.1 - 5% by wt. of arsenic.

8. An x-ray image detector according to claim 6, in which the n-layer is a thin selenium layer doped with an alkaline metal or an oxide or halogenide of said metal.

9. An x-ray image detector according to claim 8, in which the alkaline metal is selected from lithium, sodium, potassium and cesium.

10. An x-ray image detector according to claim 6, in which the p-layer is a thin layer of arsenic enriched amorphous selenium.

11. An x-ray image detector according to claim 10, in which the arsenic enrichment of the p-layer is 1-38% by wt.

12. An x-ray image detector according to claim 6, in which each of the n and p layers is less than 1 μm in thickness.

14. An x-ray image detector according to claim 1, in which said thickness of the multilayer structure is 5 to 20 μm.

15. An x-ray image detector according to claim 6, in which the light transparent biasing electrode is a co-planar indium tin oxide (ITO) layer positioned on top of the amorphous selenium based multilayer structure.

16. An x-ray image detector according to claim 6, in which the amorhpous selenium based multilayer structure is of the p-i-n type and the light transparent biasing electrode is set to a negative potential to provide the TFT with high voltage protection.

17. An x-ray image detector according to claim 6, in which the amorphous selenium based multilayer structure is of the n-i-p type, and wherein a high voltage protective device is also provided shunting the storage capacitance.

18. An x-ray image detector according to claim 1, in which the biasing electrode also serves to match indices of refraction of the scintillator and the amorphous selenium based multilayer structure.

19. An x-ray image detector according to claim 1, in which the amorphous selenium based multilayer structure is optimized for electrical transport where dark current is below 200pA/cm^2 and residual image is less than 5%.

20. An x-ray image detector according to claim 1, in which the scintillator is made of a material selected from cesium iodide doped with sodium, or from a material selected from barium fluoride, calcium tungstate and sodium iodide, emitting in the blue spectrum.

21. An x-ray image detector according to claim 1, in which the photoreceptor of the amorphous selenium based multilayer structure, the biasing electrode and the scintillator are enclosed in a housing providing environmental, electric and mechanical protection.